BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(RA)-2022/B.Tech.(RA)-2023
Course Name – Signal and Systems
Course Code - PCC-ECR303
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Identify mathematical representation of the unit impulse function.
a) δ(t) b) u(t)
c) sgn(t) d) r(t)

(ii) State the relationship between the unit impulse function δ(t) and the unit step function u(t).
a) δ(t) = u(t) b) δ(t) = u(t) - u(t-1)
c) δ(t) = u(t+1) - u(t) d) δ(t) = u(t) + u(t-1)

(iii) Given two discrete-time signals x[n] and h[n], if x[n] has a length of 4 and h[n] has a length of 3, compute the length of the resulting convolution y[n].
a) 1 b) 2
c) 3 d) 6

(iv) Choose a characteristic property of a Linear Time-Invariant (LTI) system.
a) It can exhibit exponential growth or decay. b) It can change its characteristics over time.
c) It satisfies the superposition principle. d) It can only process sinusoidal input signals.

(v) Choose from the following statements that is true regarding energy signals and power signals.
a) Energy signals have finite power, while power signals have finite energy. b) Energy signals have finite energy, while power signals have finite power.
c) Both energy signals and power signals have finite energy and power. d) Energy signals have infinite energy, while power signals have finite power.

(vi) Indicate from the following statements that is true regarding the Fourier transform of a continuous-time signal.
a) It yields a continuous frequency spectrum. b) It yields a discrete frequency spectrum.
c) It is not applicable to continuous-time signals. d) It depends on the signal's phase.

(vii) Cite the representation of the Fourier series represent.

a) A signal in the time domain
b) A signal in the frequency domain
c) A signal in both time and frequency domains
d) A signal in neither time nor frequency domains

(viii) Compare the Fourier Transform provided to the Fourier series.

a) Representation of periodic signals
b) Representation of aperiodic
c) Both representation of periodic and aperiodic signals
d) Representation of only continuous

(ix) Select a mathematical tool that can be used to transform a signal between the time domain and the frequency domain while maintaining all the signal information.

a) Laplace Transform
b) Z-Transform
c) Fourier Transform
d) Wavelet Transform

(x) Select the true statements about Fourier series.

a) Fourier series can represent any periodic function using a finite number of sinusoidal functions.
b) Fourier series is only applicable to continuous functions and cannot be used for discrete signals.
c) The coefficients in a Fourier series represent the frequency components of a signal.
d) Fourier series is a time-domain representation and cannot be converted to the frequency domain

(xi) Select the use of Nyquist-Shannon sampling theorem.

a) To analyze the frequency content of a signal
b) To reconstruct a continuous signal from its samples
c) To calculate the Fourier coefficients of a signal
d) To quantize a continuous signal

(xii) Differentiate difference between the Fourier series and the Fourier transform.

a) The Fourier series is used for periodic functions, while the Fourier transform is for non-periodic functions.
b) The Fourier series is used for non-periodic functions, while the Fourier transform is for periodic functions.
c) Both are used for the same types of functions.
d) The Fourier series is discrete, while the Fourier transform is continuous.

(xiii) Identify the use of the inverse Fourier transform.

a) Converting a signal from the frequency domain to the time domain
b) Converting a signal from analog to digital
c) Converting a signal from the Laplace domain to the time domain
d) Converting a signal from the time domain to the Laplace domain

(xiv) Choose from the following that Discrete-Time Fourier Transform (DTFT) transform a discrete-time signal into.

a) A continuous-time signal
b) A discrete-frequency signal
c) A time-domain signal
d) A time-frequency signal

(xv) Choose the property of the DTFT states that if you time-shift a signal in the time domain, it corresponds to a linear phase shift in the frequency domain.

a) Time-scaling
b) Linearity
c) Frequency-shifting
d) Time-shifting

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Apply Fourier Transform on Sin(ωt). (3)

3. Discuss linear time-invariant (LTI) and linear time variant system. (3)

4. (3)

The sampling frequency of a signal is Fs = 2000 samples per second. Determine its Nyquist interval.

5. Deduce Linearity property of Laplace Transform. (3)

6. Discuss the concept of a system. (3)

OR

Differentiate between static and dynamic systems with examples. (3)

Group-C
(Long Answer Type Questions) 5 x 6=30

7. Analyze continuous and discrete time systems. (5)

8. Evaluate Z transform of the causal sequence (5)

$$x(n) = \{1, \quad 0, \quad -4, \quad 6, \quad 5, \quad 4 \uparrow \quad \}$$

9. Apply Inverse Fourier on (5)

$\delta(\omega)$.

10. Discuss Ideal sampling technique. (5)
11. Discuss rectangular signal. (5)

12. Evaluate transfer function of the system if $y(t) = e^{-t} - 2e^{-2t} + e^{-3t}$ and $x(t) = e^{-0.5t}$ (5)

OR

Estimate the response of the system $h(t) = u(t)$ and $x(t) = e^{-2t}u(t)$ (5)

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